MULTIMEDIA **UNIVERSITY** **TM**

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

TSE 3151/TSD2711 – SOFTWARE DESIGN
(All sections / Groups)

6 MARCH 2018
2:30 p.m – 4:30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 7 pages with FOUR questions only.

2. Answer **ALL** questions.

3. Please write all your answers in the Answer Booklet provided.

QUESTION 1

(a) Refer to the following scenario and subsequently draw the corresponding use case diagram. Identify the **correct actors**, and at least 5 **use cases**.

Alice has been diagnosed with cancer and is being treated by her doctor, Carol. Carol is a cancer specialist and is aware of a Phase III trial of a new drug for the type of cancer that Alice has. The trial is a randomized un-blinded two-armed study that compares the standard of care (the treatment that Alice is currently receiving) vs standard of care plus the new drug. Two-armed means that the patients in the trial will be divided into two groups randomly (hence randomized). It is an un-blinded study, which means that patients will know which arm they are on. While Carol is not an investigator on the study, she feels that Alice should be presented with the option of participating in the study.

This use case starts after Alice has made the choice, in discussion with Carol, to participate in the study. Carol's use of Alice's health information to determine if Alice might be a candidate for research raises its own set of consent and use issues. Carol will provide Alice with treatment, including the experimental drug if Alice ends up on the experimental arm, but will not participate in the study. If Alice consents, the study team will be provided with regular data extracts from Alice's health record for the purposes of their research. To enable this data extract Bob from the study team will seek permission from Alice to participate in the study, using a standardized consent form. Alice will be assigned a study number (typically a random number of some kind.) The study team will regularly extract health data from Alice's health record in accordance with the consent until a defined study end-point is reached or Alice withdraws from the study. Each set of data collected by the study team will be de-identified (used) and tagged with Alice's study number. The de-identified data will be sent to the drug manufacturer who is the sponsor of the trial. The drug company will use the de-identified data to evaluate the study results and produce any necessary regulatory or research results.

For the purposes of this discussion group, the consent that Alice agrees to is a 'contract' which can be recorded on a block-chain. It may be the case that each data extraction and/or each transfer of data to the drug sponsor may be recorded as well.

Until the data is de-identified, the study team will record access to and uses of the data on the block-chain. These transactions on the block-chain will enable Alice to verify that her data is only being used for the purposes set out in the consent/contract and only by authorized people.

[5 marks]

Continued...

(b) Subsequently, the scenario above changes, as described in the following passage:

Once the study has been completed the study data is stored by the Study Sponsor. There are both regulatory and research reasons for this. Regulators will want to keep health data from drug trials for a long period in the event that there are long-term impacts from the drug that are not immediately apparent on trial. Researchers will want access to the data for secondary or related studies. This later gives rise to a secondary use case where Edna will want access to the data for a study. The study sponsor publishes a data dictionary describing the kind of data that they have available for researchers and Edna determines that the study in which Alice participated will provide the basis for a study that she is interested in. She initiates a request for access to the data. Dan receives the request and reviews the study in which Alice participated to determine if the study consent allows such secondary use (it usually does). Dan follows the study sponsor policies and procedures and gets Edna to sign a data sharing agreement that grants her access to Alice's data on the condition that she will neither attempt to re-identify Alice nor transfer the data to any other entity. Draw a **sequence diagram** that shows the entire scenario, beginning from consent being obtained from Alice, all the way to access being provided to Edna.
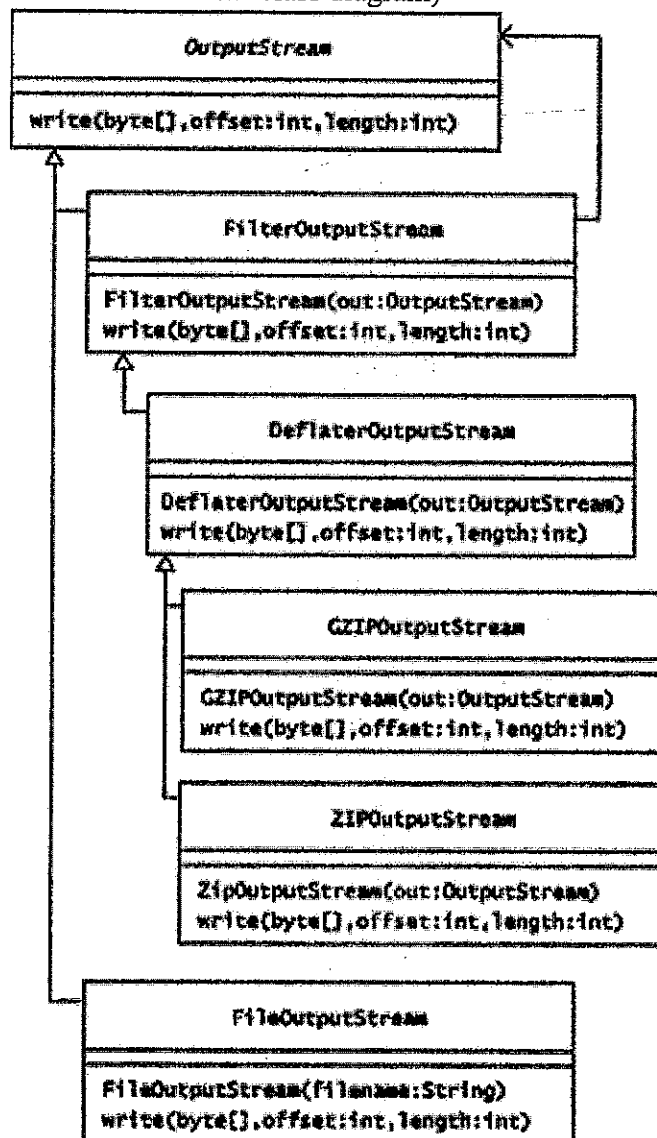
[5 marks]

Continued...

QUESTION 2

(a) Abstract classes and interfaces are the main enablers of software design patterns. Write down three differences between abstract classes and interfaces.

[3 marks]

(b) Consider the following class diagram. Identify the design pattern that is shown in the diagram , and explain how the design pattern functions (by referring explicitly to the elements shown in the class diagram)
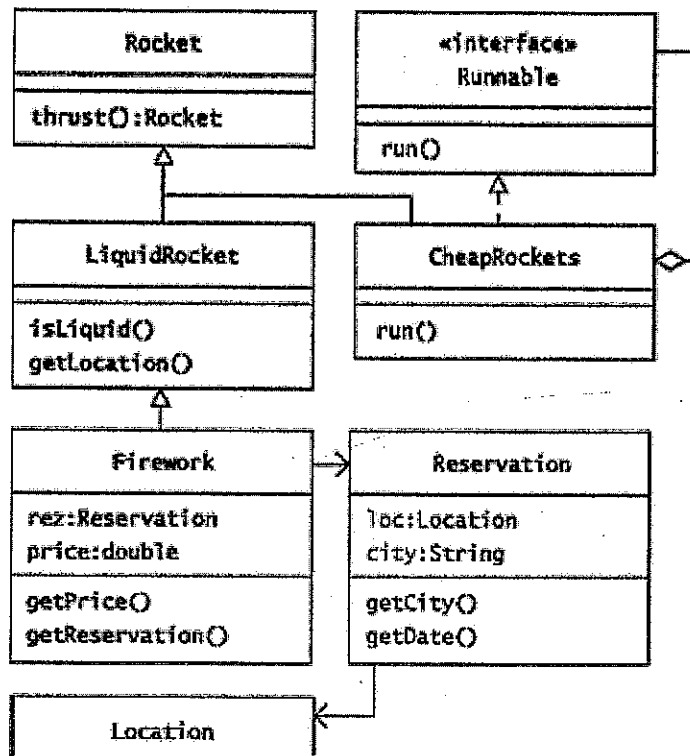
[5 marks]

```
┌─────────────────────────────────────────┐
│            OutputStream                  │
├─────────────────────────────────────────┤
│                                          │
├─────────────────────────────────────────┤
│ write(byte[],offset:int,length:int)      │
└─────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────┐
│          FilterOutputStream              │
├─────────────────────────────────────────┤
│                                          │
├─────────────────────────────────────────┤
│ FilterOutputStream(out:OutputStream)     │
│ write(byte[],offset:int,length:int)      │
└─────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────┐
│          DeflaterOutputStream            │
├─────────────────────────────────────────┤
│                                          │
├─────────────────────────────────────────┤
│ DeflaterOutputStream(out:OutputStream)   │
│ write(byte[],offset:int,length:int)      │
└─────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────┐
│            GZIPOutputStream              │
├─────────────────────────────────────────┤
│                                          │
├─────────────────────────────────────────┤
│ GZIPOutputStream(out:OutputStream)       │
│ write(byte[],offset:int,length:int)      │
└─────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────┐
│             ZIPOutputStream              │
├─────────────────────────────────────────┤
│                                          │
├─────────────────────────────────────────┤
│ ZipOutputStream(out:OutputStream)        │
│ write(byte[],offset:int,length:int)      │
└─────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────┐
│            FileOutputStream              │
├─────────────────────────────────────────┤
│                                          │
├─────────────────────────────────────────┤
│ FileOutputStream(filename:String)        │
│ write(byte[],offset:int,length:int)      │
└─────────────────────────────────────────┘
```

Continued...

(c) Examine the following class diagram. Identify two problems that arises due to the design shown in this class diagram.

[2 marks]

Continued...

QUESTION 3

(a) Explain the characteristics of a layered architecture, and draw a diagram that shows a layered architecture for a typical web application.   [5 marks]

(b) State 3 usage of a framework.   [3 marks]

(c) A diagram showing the Model View Controller is shown below. Based on your understanding of both design patterns and architectural framework, explain whether MVC is design pattern or an architectural framework

[2 marks]
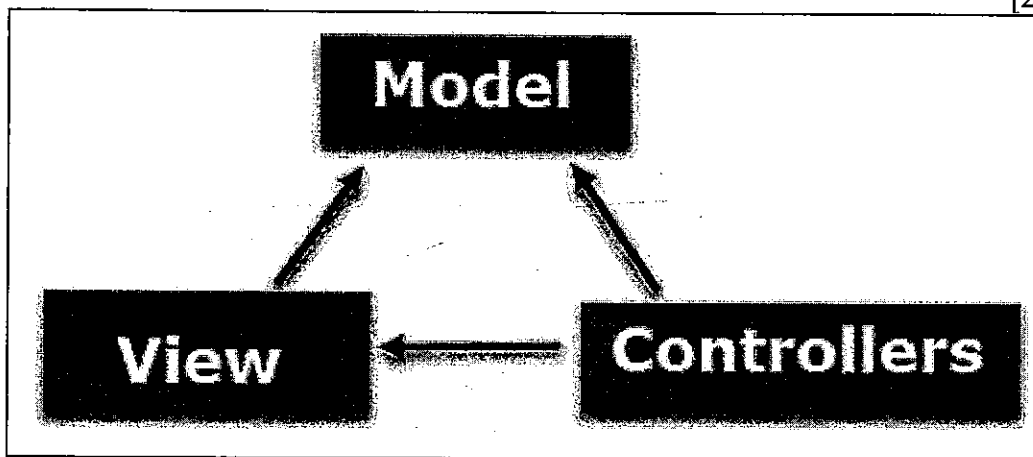
Continued...

QUESTION 4

(a) Consider the following scenario. Represent the scenario using a Jackson Structured Programming (JSP) diagram.

You need a program that calculates the checkout total for a customer at a cash-and-carry. To shop at this cash-and-carry, you need to be a member and memberships come in three types: bronze, silver and gold. Each membership type gets its own discount! A customer at a checkout first gives details of their membership card. The checkout assistant then scans in each item. The price is retrieved from the stock database. All the items are added up and the appropriate discount subtracted from the total. The checkout assistant then tells the customer how much is due. They receive cash from the customer, then calculate and give out the change as well as an itemized receipt.

In your solution, ensure that selection and iteration steps are shown in the diagram.

[5 marks]

(b) State two diagrammatical forms for Jackson System Development.   [2 marks]

(c) What are the three Jackson Structured Programming heuristics?   [3 marks]

End of pages.